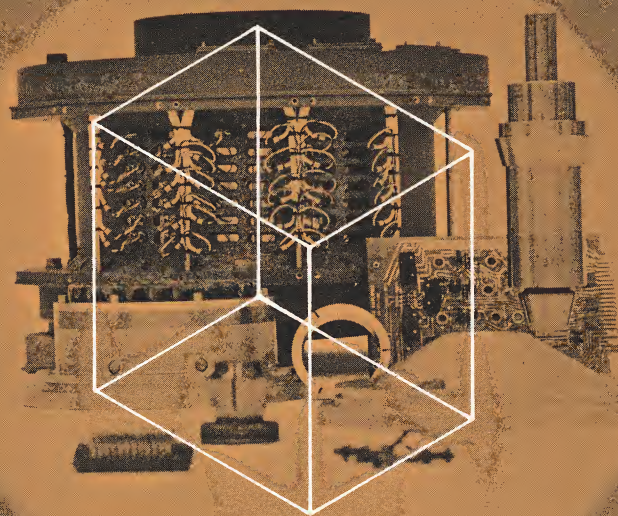
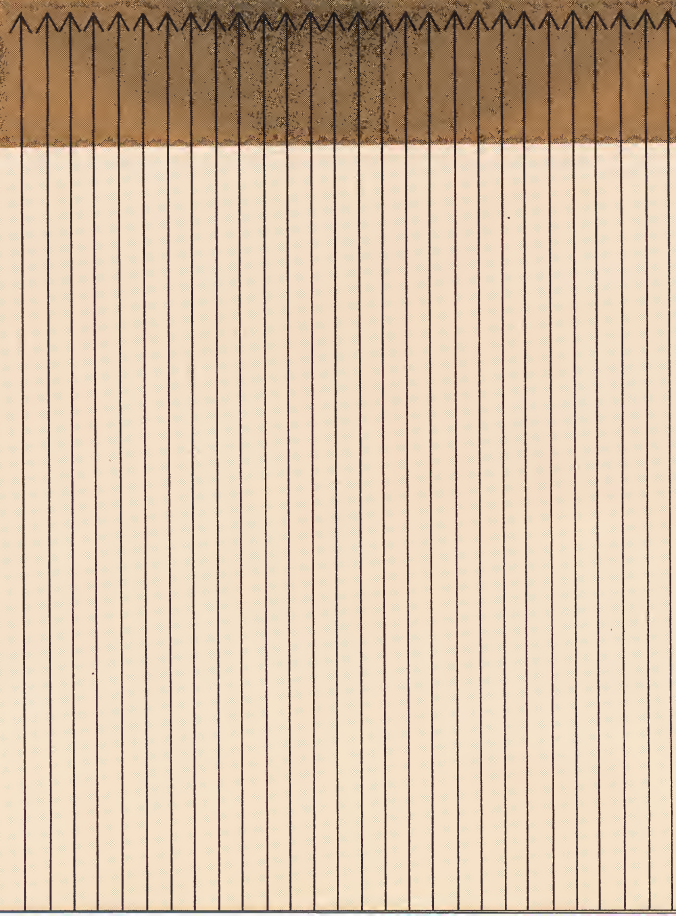




MAGNE-HEAD

DRUM MEMORY SYSTEMS



TRANSIENT ERROR RATE

<1 BIT IN 10^{12} BITS

SINGLE BIT ALTERATION PHASE MODULATION RECORDING

<3 MICROSECONDS

WRITE TO READ RECOVERY

These are standard features — not extra - cost “options”
— of Magne-Head magnetic drum memory systems.

LOW ERROR RATE

Reliability is of prime importance in any system.

Magne-Head systems must test to a transient error rate of less than one bit in 10^{12} bits.

This error rate is achieved with $\pm 5\%$ power supply deviation and with worst case bit patterns applied to 100% of the drum surface.

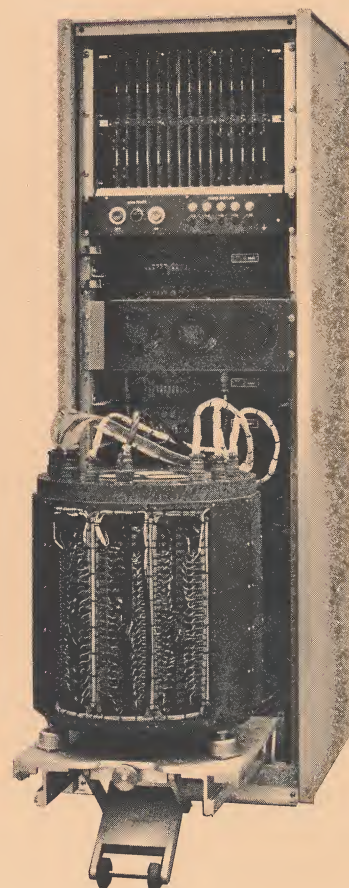
FLEXIBLE RECORDING TECHNIQUES

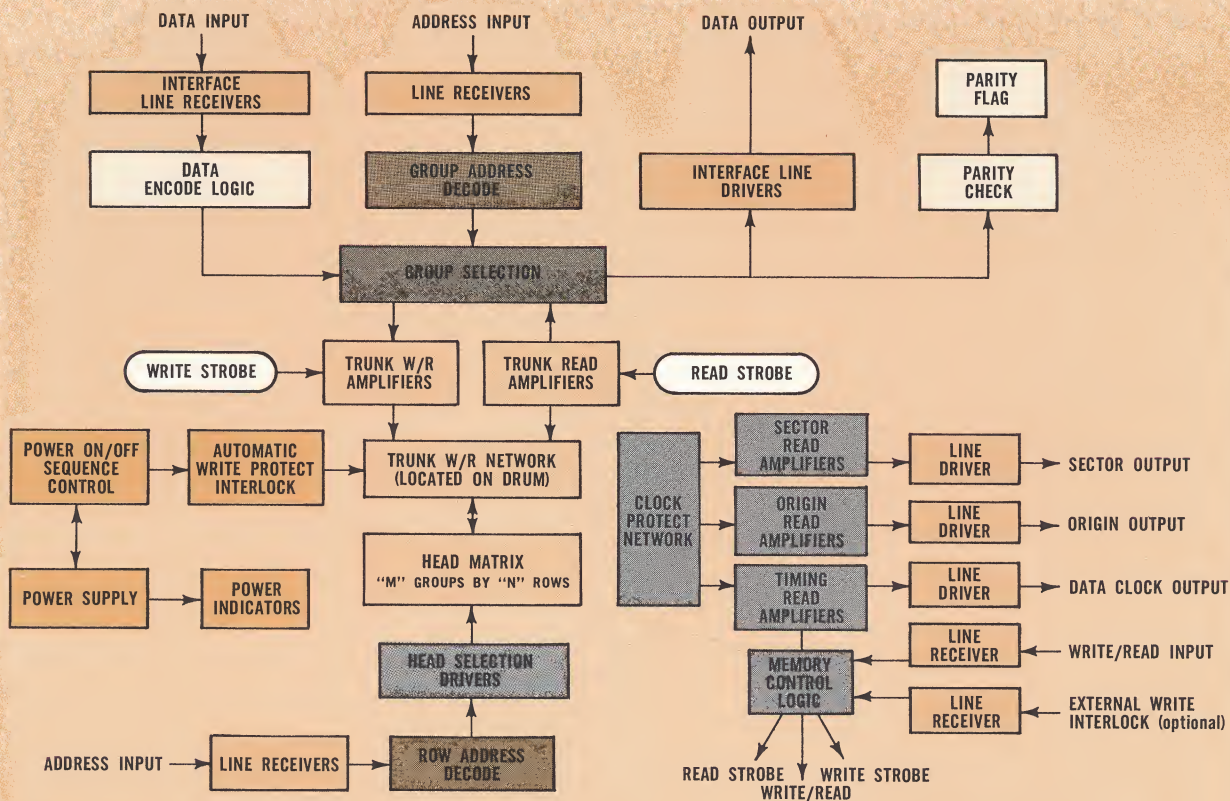
Single bit alteration coupled with phase modulation recording permits reliable operation at high bit transfer rates and packing densities. Development of this technique makes it practical, for example, to record an 8-bit character in parallel at 1 megacycle, packed 600 characters per inch.

FAST RESPONSE

Less than 3 microseconds write-to-read recovery cuts average system access time. With look-ahead programming, it's now possible to read time-adjacent information blocks without waiting for a full drum revolution.

Magne-Head Systems include the interface logic necessary for data exchange between the memory and the data source. Circuit elements accept any digitally coded data and return it on command to its source. This interface versatility minimizes the number of lines necessary to communicate with the memory. For example, less than 30 lines are required to access 16,000,000 bits of information. Standard recording and play-back methods may be implemented with one read-write amplifier design. All magnetic drums in the Magne-Head line — D50, D500, D5000 — are compatible with this design. “Class A Commercial” is the minimum manufacturing standard at Magne-Head. Magne-Head Systems may also be specified to meet the requirements of MIL-E-4158B and MIL-E-4970A. High manufacturing standards pay off in low-cost maintenance, increased system life and years of trouble-free operation. Look to Magne-Head for drum memories. Consult the data; note the wide range of application of Magne-Head systems. Our engineering people look forward to working with you on any system problem: 50 kilocycles to 1 megacycle; 50 kilobits to 100 megabits.





SINGLE BIT ALTERATION AT 500 BITS PER INCH USING PHASE MODULATION RECORDING

1. The following demonstrates Magne-Head's capability in single bit alteration using Phase Modulation recordings at moderately high packing densities. The example used illustrates 500 bits per inch. The photograph shows that 500 bits per inch is not the limit of the head or coating. This is evident because there is no adjacent pulse shift or attenuation when a bit is removed or inserted. Wave forms were photographed at the output of a standard Magne-Head read amplifier.

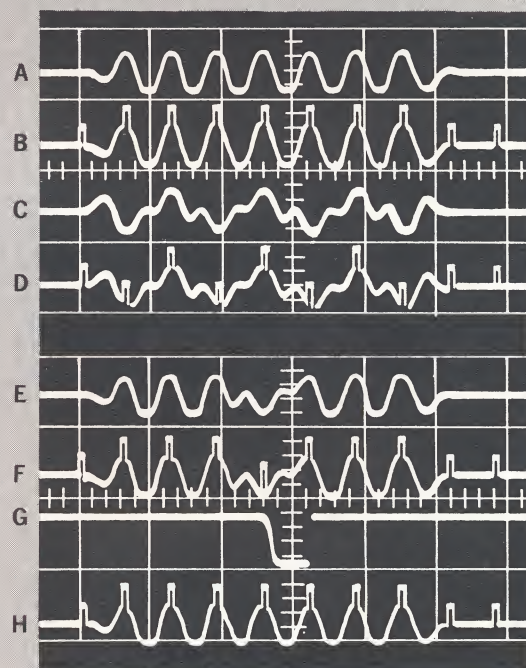
2. Oscilloscope Calibration

Sweep 2.0 microseconds/cm
Sensitivity 20.0 volts/cm

3. Drum Specifications

Speed	3600 RPM
Diameter	8 inches
Bits/track	12,560
Bit Packing Density	500 per inch
Flux Reversals	1000 per inch
Clock Frequency Read	743 KC
Clock Frequency Record	1.486 MC

Trace A	A one (1) in each cell.
Trace B	Read strobe superimposed.
Trace C	One (1) - Zero (0) pattern.
Trace D	Read strobe superimposed.
Trace E	Fourth cell modified to a zero (0).
Trace F	Read strobe superimposed.
Trace G	Read amp D.C. restored output.
Trace H	Fourth cell modified to a one (1).



SYSTEMS DATA

Total Storage	50K to 100 million bits
Data Transfer Rate Bit Serial or Bit Parallel	to 1 megacycle
Data Input Requirements	0V and -5 to 20V or 0V and +5 to or +20V
Address and Control Line Input Requirements	0V and -5 to -20V or 0V and or +5 to +20V
Data Input Format	Bit serial, parallel, serial - parallel.
Data Editing	Single bit, single character, block, bit or character interlace.
Clock Output	0V and -5 to -12V
Data Output	or 0V and +5 to +12V
Primary Power Input Any one of the following	120V single phase 60 cps 120/208V 3 phase 60 cps 120V single phase 400 cps 120/208V 3 phase 400 cps
Write to Read Recovery	3 microseconds maximum in an 8 x 64 matrix.
Read to Read and Read to Write Recovery	500 nanoseconds maximum in an 8 x 64 matrix.
Error Rate	<1 in 10 ¹² bits
Access Time	4 to 35 milliseconds average.
Clock protect	to 100V DC
Optional Functions	Memory busy Flag, Parity flag Non destructive power loss. Any frequency primary power.



MAGNE-HEAD *a division of General Instrument Corp.*

13040 South Cerise Avenue * Hawthorne, California 90250 * 213 679-3377/772-2351 * TWX910-325-6203

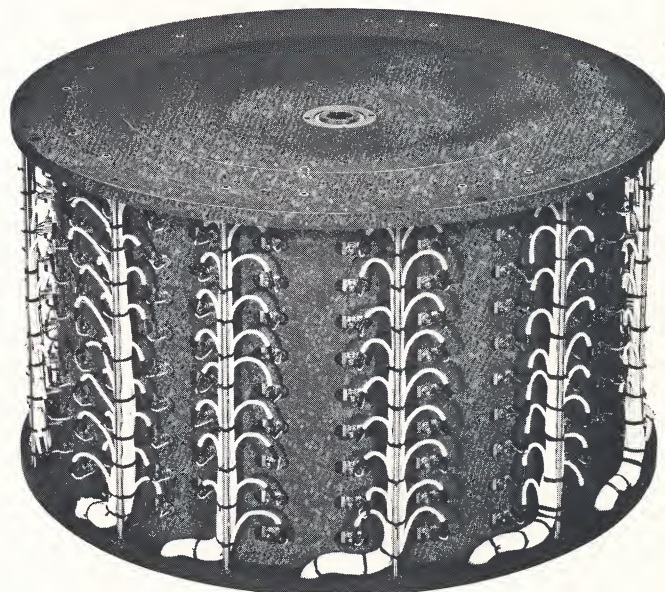


D5000

BULK STORAGE MAGNETIC MEMORY DRUM

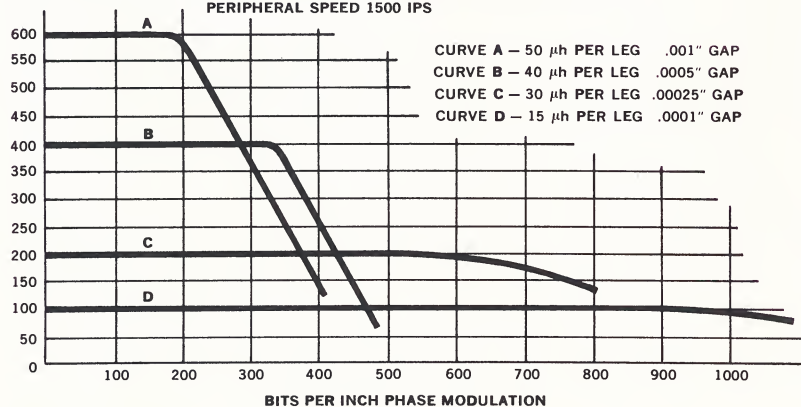
FEATURES:

- **DEPENDABILITY:** *Plated metal magnetic coating provides the optimum recording surface—hard and durable.*
- **CONVENIENCE:** *Record-play heads may be inserted while the drum is running, with no radial adjustment.*
- **CAPACITY:** *Bit packing densities to 2000 per inch NRZ (1000 per inch phase modulation, R.B., or R.Z.)*
- **SIGNAL TO NOISE RATIO:** *26 db.*
- **VERSATILITY:** *Compliance with applicable military specifications—ground, shipboard, airborne.*



Typical section of D5000 Series drum—18" diameter, 1800 RPM. 20,000,000 bit capacity per section, 4 sections can be stacked to expand total bulk storage memory to as many as 80,000,000 bits.

TYPICAL OUTPUT IN M.V. PEAK TO PEAK (1500 OHM LOAD) AIR FLOATING HEAD
PERIPHERAL SPEED 1500 IPS



A PLAYBACK SIGNAL VERSUS PACKING DENSITY GRAPH shows output signal levels over a wide range of frequencies. (Frequency equals peripheral speed in inches per second times packing density in bits per inch phase modulation.) Curves illustrated reflect a peripheral speed of 1500 inches per second. Different speeds produce a roughly linear change in signal level. Outputs shown on the graph are conservatively de-rated. Production experience exceeds these ratings by approximately 25%.

D5000 MODULAR DRUM

The D5000 Bulk Storage Magnetic Memory Drum employs a new technique of modular section construction which permits the stacking of sections to expand bulk storage capacity. Each modular section has a total memory capacity of 20,000,000 bits and four sections can be stacked to expand total bulk storage memory to as many as 80,000,000 bits. Each individual section incorporates all of the design features of Magne-Head's D50 and D500 Series of Magnetic Memory Drums.

The modular section drum is ideal for computers designed for bulk storage memory and whose total memory varies as a function of application such as in Process Control and Inventory Control. In applications of this nature, where total bulk storage capacity is an unknown or varying factor, the modular section technique of stacking eliminates the necessity of specifying a special drum for each size of memory and the need for anticipating the optimum memory requirement of the application.

To the systems designer, all of this means fewer interface restrictions when integrating the memory subsystem into the total system.

Magne-Head drums meet a broad range of operational requirements because of flexible design within a framework of dependability. Features and design parameters tailored to meet individual application needs include drum size, speed, and motor type...record-play head inductance, head layout, and wiring harness arrangements.

For military systems, D5000 Series drums are designed to meet these typical specifications:

Ground Based:	MIL-E-4970A and MIL-E-4158B
Shipboard:	MIL-E-16400E
Airborne:	MIL-E-5400

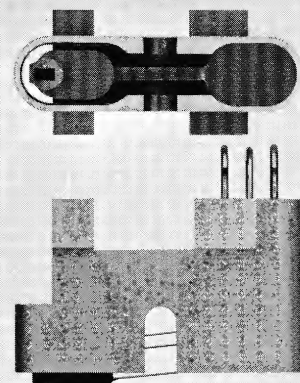
D 5 0 0 0 D E S I G N D A T A

DIAMETER:	18" per section
LENGTH:	12" per section
MAXIMUM NO. OF SECTIONS:	4
ECCENTRICITY:	Less than .000050 inches
BEARINGS:	Class 9; factory sealed and lubricated
MOTOR:	Custom designed integral motor, induction or synchronous
ROTATION SPEED:	900, 1800, 3600 RPM
TRACKS PER INCH:	40 nominal
TOTAL STORAGE CAPACITY:	20,000,000 bits per section
MAXIMUM CLOCK RATE:	2 megacycles
MAGNETIC MEDIUM:	Hard nickel-cobalt plate. By becoming an integral part of the rotating member, the plated surface eliminates dusting and flaking problems inherent with iron oxide coatings. Extreme surface hardness greatly reduces susceptibility to catastrophic failure should foreign matter come in contact with the rotating member.

RECORD-PLAY HEADS

The unique aerodynamic head developed by Magne-Head cuts installation and adjustment time to a fraction of that required for conventional, non-contact heads. To add or replace a head, simply insert it at the desired location and lock it in place, *all without stopping the drum*. Head and head slot design make it virtually impossible to damage either the head or the drum coating during the installation process.

Electrical specifications such as head inductance and drive current requirements may be varied to suit the application.





D50 SERIES AIRBORNE MAGNETIC MEMORY DRUMS

FEATURES:

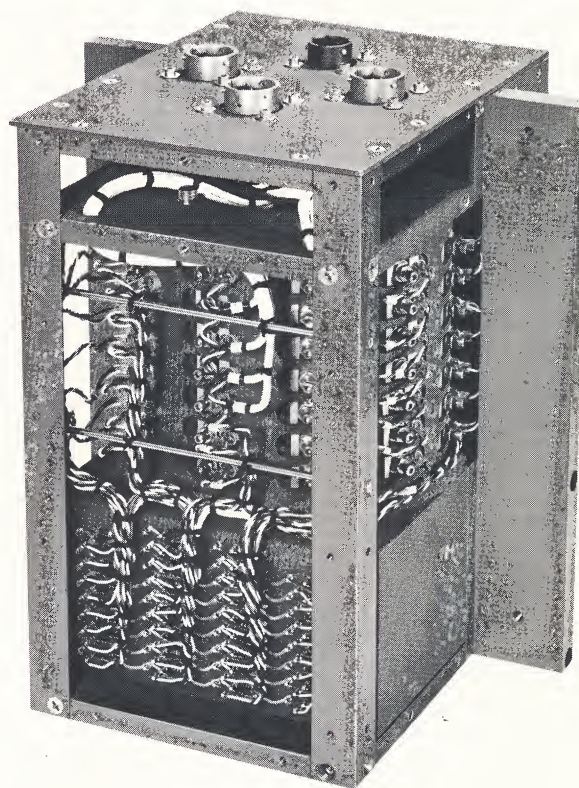
● **DEPENDABILITY:** *Plated metal magnetic coating provides the optimum recording surface—hard and durable.*

● **CONVENIENCE:** *Record-play heads may be inserted while the drum is running, with no radial adjustment.*

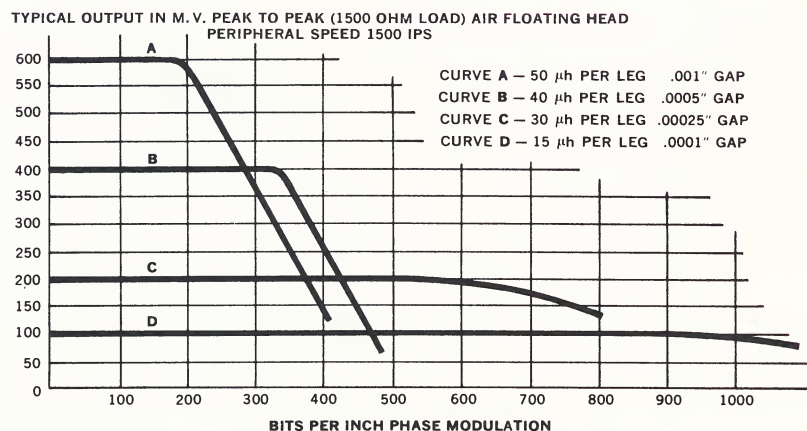
● **CAPACITY:** *Bit packing densities to 2000 per inch NRZ (1000 per inch phase modulation, R.B., or R.Z.)*

● **SIGNAL TO NOISE RATIO:** 26 db.

● **VERSATILITY:** *Compliance with applicable military specifications—ground, shipboard, airborne.*



Typical D50 Series drum—4" diameter, 3600 RPM.
Other diameters available in the
D50 Series from 3" to 6".



A PLAYBACK SIGNAL VERSUS PACKING DENSITY GRAPH shows output signal levels over a wide range of frequencies. (Frequency equals peripheral speed in inches per second times packing density in bits per inch phase modulation.) Curves illustrated reflect a peripheral speed of 1500 inches per second. Different speeds produce a roughly linear change in signal level. Outputs shown on the graph are conservatively de-rated. Production experience exceeds these ratings by approximately 25%.

D50 DRUM

All drums in the small to medium size D50 Series share basic design features. Magne-Head design criteria provide superior performance: more bits per square inch of recording surface, higher output signal levels, and long term maintenance-free operation. To the systems designer, all of this means fewer interface restrictions when integrating the memory subsystem into the total system.

Magne-Head drums meet a broad range of operational requirements because of flexible design within a framework of dependability. Features and design parameters tailored to meet individual application needs include drum size, speed, and motor type...record-play head inductance, head layout, and wiring harness arrangements.

For military systems, D50 Series drums are designed to meet these typical specifications:

Ground Based: MIL-E-4970A and
MIL-E-4158B
Shipboard: MIL-E-16400E
Airborne: MIL-E-5400

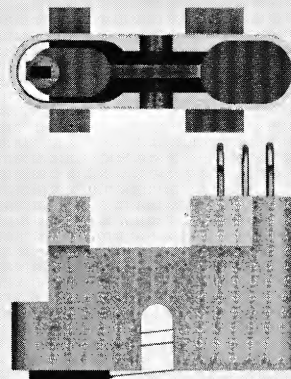
D50 DESIGN DATA

DIAMETER:	3 to 6 inches
LENGTH:	1 to 10 inches
ECCENTRICITY:	Less than .000050 inches
BEARINGS:	Class 9; factory sealed and lubricated
MOTOR:	Custom designed integral motor, induction or synchronous
ROTATION SPEED:	Speed limits are set by rotating member diameter. Maximum speed for D50 Series drums is 24,000 RPM, at a diameter of 3 inches.
TRACKS PER INCH:	40 nominal
TOTAL STORAGE CAPACITY:	Approximate storage capacity ranges between these limits, according to drum size: 3" diameter x 1" length—270,000 bits phase modulation 6" diameter x 9" length—5,400,000 bits phase modulation
MAXIMUM CLOCK RATE:	2 megacycles
MAGNETIC MEDIUM:	Hard nickel-cobalt plate. By becoming an integral part of the rotating member, the plated surface eliminates dusting and flaking problems inherent with iron oxide coatings. Extreme surface hardness greatly reduces susceptibility to catastrophic failure should foreign matter come in contact with the rotating member.

RECORD-PLAY HEADS

The unique aerodynamic head developed by Magne-Head cuts installation and adjustment time to a fraction of that required for conventional, non-contact heads. To add or replace a head, simply insert it at the desired location and lock it in place, *all without stopping the drum*. Head and head slot design make it virtually impossible to damage either the head or the drum coating during the installation process.

Electrical specifications such as head inductance and drive current requirements may be varied to suit the application.





D500

SERIES

MAGNETIC MEMORY DRUMS

FEATURES:

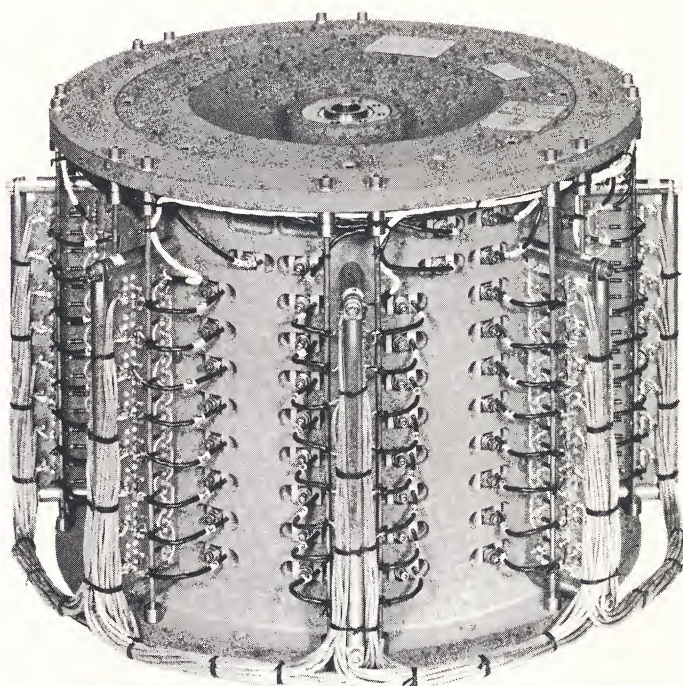
● **DEPENDABILITY:** *Plated metal magnetic coating provides the optimum recording surface—hard and durable.*

● **CONVENIENCE:** *Record-play heads may be inserted while the drum is running, with no radial adjustment.*

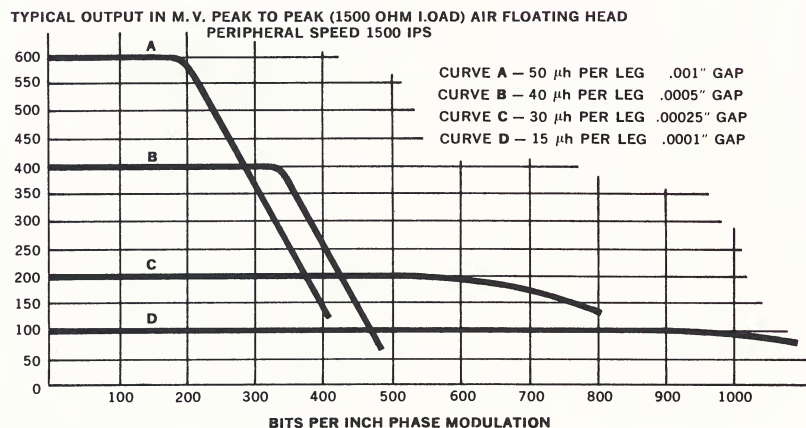
● **CAPACITY:** *Bit packing densities to 2000 per inch NRZ (1000 per inch phase modulation, R.B., or R.Z.)*

● **SIGNAL TO NOISE RATIO:** 26 db.

● **VERSATILITY:** *Compliance with applicable military specifications—ground, shipboard, airborne.*



Typical D500 Series drum—9" diameter, 3600 RPM.
Other diameters available in the D500 Series
from 6" to 12".



A PLAYBACK SIGNAL VERSUS PACKING DENSITY GRAPH shows output signal levels over a wide range of frequencies. (Frequency equals peripheral speed in inches per second times packing density in bits per inch phase modulation.) Curves illustrated reflect a peripheral speed of 1500 inches per second. Different speeds produce a roughly linear change in signal level. Outputs shown on the graph are conservatively de-rated. Production experience exceeds these ratings by approximately 25%.

D500 DESIGN DATA

All drums in the medium size D500 Series share basic design features. Magne-Head design criteria provide superior performance: more bits per square inch of recording surface, higher output signal levels, and long term maintenance-free operation. To the systems designer, all of this means fewer interface restrictions when integrating the memory subsystem into the total system.

Magne-Head drums meet a broad range of operational requirements because of flexible design within a framework of dependability. Features and design parameters tailored to meet individual application needs include drum size, speed, and motor type...record-play head inductance, head layout, and wiring harness arrangements.

For military systems, D500 Series drums are designed to meet these typical specifications:

Ground Based: MIL-E-4970A and
MIL-E-4158B
Shipboard: MIL-E-16400E
Airborne: MIL-E-5400

D 5 0 0 D E S I G N D A T A

DIAMETER:	6 to 12 inches
LENGTH:	1 to 18 inches
ECCENTRICITY:	Less than .000050 inches
BEARINGS:	Class 9; factory sealed and lubricated
MOTOR:	Custom designed integral motor, induction or synchronous
ROTATION SPEED:	Speed limits are set by rotating member diameter. Maximum speed for D500 Series drums is 12,000 RPM, at a diameter of 6 inches.
TRACKS PER INCH:	40 nominal
TOTAL STORAGE CAPACITY:	Approximate storage capacity ranges between these limits, according to drum size: 6" diameter x 1" length—570,000 bits phase modulation 12" diameter x 18" length—20,000,000 bits phase modulation
MAXIMUM CLOCK RATE:	2 megacycles
MAGNETIC MEDIUM:	Hard nickel-cobalt plate. By becoming an integral part of the rotating member, the plated surface eliminates dusting and flaking problems inherent with iron oxide coatings. Extreme surface hardness greatly reduces susceptibility to catastrophic failure should foreign matter come in contact with the rotating member.

RECORD-PLAY HEADS

The unique aerodynamic head developed by Magne-Head cuts installation and adjustment time to a fraction of that required for conventional, non-contact heads. To add or replace a head, simply insert it at the desired location and lock it in place, *all without stopping the drum*. Head and head slot design make it virtually impossible to damage either the head or the drum coating during the installation process.

Electrical specifications such as head inductance and drive current requirements may be varied to suit the application.

